# Coach to learn and learn to coach: synergising performance and development in the athlete-coach-environment learning system

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## Abstract

While high-performance sport traditionally highlights a dualist perspective on distinct pathways of development and performance coaching, an ecological dynamics rationale recognises the deeply entwined relations between development and performance. Acknowledging an *athlete-environment-centred* approach, an increasingly relevant topic concerns 'coach learning', supporting the idea that theories of athlete development present useful insights for understanding coach development. In this position paper, it is argued that athlete and coach learning are not independent from one another, thus forming part of an *athlete-coach-environment learning system*. This first of two insights papers discusses the contiguity between athlete development and performance and coach learning. It seeks to highlight a dual coach learning pathway towards 'coaching to learn' (infused by *knowledge of* the environment) and 'learning to coach' (supported by *knowledge about* the environment). To underline the interconnectedness of athlete/coach learning, two examples are discussed from: I) the 2021 Wheelchair Rugby League World Cup; and II), high-performance workshops for Olympic sport coaches.



**Keywords:** Coach learning; development and performance; ecological dynamics; athlete-coach environment system; adapting to constraints

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## Introduction

In high-performance sport, an important focus of coaches, support practitioners and academics is to deepen understanding of how athletes learn to adapt their actions, becoming more skilful in their competitive performance context (Araújo & Davids, 2011; Otte et al., 2021). In the past few decades, there have been different phases in emphasis on understanding how coaching can be improved to achieve this key aim (North, 2017). In preparing coaches for these professional challenges, the nature of coach training and research on coaching practice has shifted in emphasis from formalised coach education programmes towards enhancing coach learning and development. While coaches typically share insights in communities of practice that encourage reflection and informal exchanges (North, 2017; Stodter & Cushion, 2019), more recently, the development of coaches' knowledge and skills to support learning opportunities for athletes has become a major focus for sport governing bodies and researchers around the world. There are some concerns that current coach education programmes need to contemporise the theoretical frameworks that have underpinned pedagogical practice and coach learning (Wood et al., 2023). The primary function of coach development is to improve coaching practice (Rynne and Mallett, 2010), and in previous years there may have been a fixation on compliance for licensing and accrediting coaches (Lara-Bercial et al., 2023).

Despite frequent recommendations for transformations in coach education, a research-practice gap is perceived to persist (Lyle, 2018), with a continuation of coach education programmes based upon overly simplistic models of learning (Paquette & Trudel, 2018). Moreover, Nelson et al. (2013, p. 205) have argued that coach education provision itself has tended to be "under-theorised", that in turn can lead to a culture of coaching that is rather exposed to coaches' past experiences and their surrounding socio-cultural-historical

environments, and therefore, is not based on a theory of learning. Even when coach education programmes are based on learning theory, empirical investigations have indicated that coach developers may not have sufficient knowledge and experience to effectively educate coaches about learning theories, evident in Stodter and Cushion's (2019) exploration of English coach developers. Misalignment between espoused learning theories and applied practice, can contribute to situations where pseudoscientific ideas and neuro myths, shared through social learning spaces, take precedence over empirically tested learning theories (Bailey et al., 2018). In this paper, we suggest a re-emphasis to challenge and progress coach learning, contemporising the theoretical ideas used to support their training, education, learning, and development of emotional intelligence, to help them become thoughtful, inspiring, and innovative practitioners (for a summary see Wood et al., 2023). In their seminal paper, Nelson et al. (2006) preferenced the use of the holistic term *coach learning*, suggesting that it counters the potentially limiting discourse associated with an alternative: *coach education*. For example, the term 'teacher education' may have become fundamentally implicated in a Foucauldian perspective of traditional pedagogical methods, being associated with a process of prescription and 'instructionist management' (for a critical analysis of this idea, see Pitsoe & Letseka, 2013). In contrast, the term *coach learning* shifts the narrative toward considering the needs of the individual learner in meeting the challenge of continuously refining their behaviours, knowledge or skills (Nelson et al., 2006). It is argued that *coach learning* more accurately represents how coaches may engage with formally supported and unsupported activities when developing the skills, knowledge and expertise required to perform effectively in their professional context. Despite many formal learning opportunities suggesting a learner-centred approach, many experiences are to the contrary; for example, there have been reported experiences of prescriptive approaches to 'what' and 'how' to coach (Dempsey et al., 2020; Cushion et al., 2021). Such experiences in coach learning mirror contemporary

criticisms of traditional motor learning ideas, underpinning instructionist and prescriptive pedagogical methods in sport (e.g., Chow et al., 2022). Contrary to this approach, like athlete learning and development (e.g., Davids et al., 2021), coach learning and development may be considered an ongoing, dynamic process of refined adaptation. This adaptation can emerge within and outside the ecology of formal coach training and education. While there appear different theoretical approaches which may underpin coach learning and development, here we discuss

a contemporary, complex systems-oriented, ecological model that emphasises the emergence over extended time of a tightly knit athlete-environment relationship as the basis of performance and development in sport (e.g., Davids et al., 2021).

In this position paper, we highlight how athlete learning and preparation, and coach learning, form an intimately entwined part of an *athlete-coach-environment learning system,* where day-to-day interactions operate reciprocally to shape context dependent learning (Orth et al., 2019). This paper forms the first part of two interlinked position statements offering insights on the case for re-framing coach learning using an ecological dynamics perspective, i.e., situated within a dynamic athlete-coach-environment learning system. An ecological dynamics rationale for teaching, coaching, coach and teacher education and sports pedagogy seeks to place the individual learner (and not the parent, coach or teacher) at the centre of the learning process (Chow et al., 2022). This perspective views the relationship between the individual learner, coach and environment as deeply intertwined. While ecological dynamics is not the only theoretical framework that places the learner at the centre of learning programmes, there have been few previous attempts to frame the coach learning and development process from that perspective. Here, we outline how an ecological dynamics rationale may contribute to understanding within the wider coach learning literature.

The transdisciplinary nature of ecological dynamics (e.g., merging specialist coach, scientist,

and athlete knowledge derived from experience, data insights, sport science, and theory; Rothwell et al., 2020), could help advance understanding of how high-performance sport coaches may become proficient at creating effective and trusting partnerships with athletes, while at the same time developing experience of facilitating functional training environments that drive athlete development and performance preparation.

***Briefly outlining critical issues of reductionist coach learning and education.***

An important issue in ecological dynamics, that will be explored in this paper, concerns the proximity between how both coaches and athletes learn to adapt their performance and skills to the informational dynamics (e.g., environmental and task constraints) that emerge in varying performance contexts. Recent work by Wood and colleagues (2023, p. 611) highlighted how coach learning, like athlete learning, may be considered "as a process of searching for (exploring) and then exploiting (attuning to) the information that specifies relevant affordances [i.e., opportunities and invitations for action] of an environment for more effective coaching". An ecological perspective on learning has been previously applied to the study of athletes and teams (e.g., Renshaw et al., 2010). Its relevance for understanding athlete-coach-environment relationships (in practice) has been rarely acknowledged but has become increasingly clear. Both athletes and coaches need to develop *knowledge about* and (particularly) *knowledge of* (Gibson, 1979) performance and development environments (e.g., see Morris et al., 2022; Wood et al., 2023). Due to the strong emphasis on licence registration and accreditation procedures, common approaches to coach learning often promote reductionist and reproductive methods. Coach education programs and courses rarely acknowledge or facilitate coach and athlete learning as a reciprocal and integrated process, where athlete and coach development and performance evolves side by side (Morris et al., 2022). This challenge is not unique to coach and athlete learning, many educational and professional training contexts, such as medical education of

physicians for effective decision making in novel situations, have been criticised for preferencing second-hand experiences (i.e., those experiences devoid of environmental context and promoting reproduction of a dominant discourse; e.g., Mylopoulos et al., 2018). For example, expressing dissatisfaction with the traditional organisation of educational and professional development environments to focus solely on secondary experiences, the ecological psychologist Edward Reed (1996, p.2) argued:

> "… we have organised our world to undermine primary experience. In those activities in particular to which we devote most of our time - work, school, leisure - we now emphasise learning *about* things (using second-hand experience), and we limit our opportunities for primary experience."

These ideas are relevant for coach education, prompting several important questions. Amongst the general inquiry of how coaches could develop coaching knowledge and (research-supported) methods, one critical issue concerns the question: *Do coaches learn to coach (through secondary experiences), coach to learn (through primary experiences), or do both simultaneously?* Raising awareness of the abovementioned questions, this two-part series aims to extend the rich literature on both athlete and coach development and performance. Past commentaries have provided provocative insights on re-framing an *internalised view of learning* as skill acquisition to an ecological process of 'skill adaptation' (Araújo & Davids, 2011). Skill adaptation emphasises the ongoing relations between development and performance in the refinement of expertise and skill through continuous interactions with the environment. These arguments eschew the provision of solely philosophical contributions to understanding and seek to get to the pragmatic heart of what it means to develop skills and expertise in domains such as sport (Woods et al., 2022).

In contrast to traditional athlete development and performance programmes, emphasising fixed training environments and the existence of skills and expertise as

decontextualised reality and ideal or prototypic entities (Juarrero, 2023), contemporary learning approaches, such as ecological dynamics advocate the importance of a relational approach emphasising adaptation to constraints (Araújo & Davids, 2011). Ecological principles of skill adaptation advocate learning and development by emphasising practice '*efficiency*', as well as '*effectiveness*' over 'idealised forms, kinds or movement types' (see Rothwell et al., 2020). For example, by practising in representative tasks, avoiding over-training via repetition of idealised techniques and pre-determined movements for excessive time periods, and emphasising peer involvement and coach-guidance in co-designing exploratory environments, efficiency of practice designs may well be enhanced. Further, a focus on functionality in achieving a performance goal, searching for and finding various performance solutions, adapting to the contextual dynamics of an uncertain performance environment, and making time to safely explore innovative ways of performing, prove beneficial as ways of increasing effectiveness (Rothwell et al., 2023).

A range of academic research investigations and practitioner case studies (for examples see Chow et al., 2022; Button et al., 2022; Otte et al., 2019, 2020, 2021; Rothwell et al., 2023; Wood et al., 2023) have illustrated how these ideas in ecological dynamics are relevant for all individuals seeking to enhance their expertise and skill performance in all domains. They are as relevant for athletes as they are for coaches learning, developing and performing in their different roles in sport.

Notably, the interlinked papers in this two-part series will predominantly focus on high-performance coach learning and development and the related opportunities, pressures, and constraints (i.e., at a level of performance beyond 'recreational' competition and, rather, including developmental pathways and competitive levels at the regional, national and international scale). As the proposed coach learning and development position, and context, is highly nuanced, we provide examples from two high-performance coaching contexts to

highlight how individualised and contextualised this challenge can be, with each being shaped by different social, cultural, historical and political influences. These applied insights, based on an integration of practical experience and applied scientific understanding, are exemplified in this paper by drawing on examples of training and development coaching in: I) preparation for the 2021 Wheelchair Rugby League World Cup; and II), the delivery of high-performance coaching workshops for professional football and other Olympic sport coaches.

## The deeply entwined and ongoing relationship between athlete development and preparation for competitive performance: Concepts from Ecological Dynamics

From a theoretical perspective, ecological dynamics highlights the emergent functional relationships (synergies) that individuals (e.g., athletes or coaches) form with their surrounding environments (e.g., a particular moment in a football game or more broadly, the organisational culture within a football club), constantly coupling perception of information with intended (i.e., goal-directed) actions. The couplings formed between individuals and their environments are ubiquitous, driven by regular practice and performance, and the learning and experience that emerges from this. The hallmark notion that 'context is everything' supports the specificity of skill learning and performance in high-performance sports (Davids et al., 2021). With the goal of holistically showcasing nonlinear, complex dynamics between coaches, athletes and further parties in high-performance sport, we developed Figure 1 to emphasise numerous critical concepts for practitioners to consider, including: learning to coach; coaching to learn; and the mutual relationship between development and performance (for both coaches and athletes alike). Part I of this series will address key concepts inside of the (red) triangle in Figure 1. Based on an ecological dynamics rationale for performance and development of skills and expertise, it aims to display coach learning in close proximity to the athlete. Particularly in the following, we reflect on: *(i), how*

*athletes develop their skills and continue to refine their understanding of performance in their sport; (ii), the deeply entwined relationship between coach and athlete development, AND their competitive performance in high-performance sports*; and *(iii), the proposed dual coach learning pathway.*

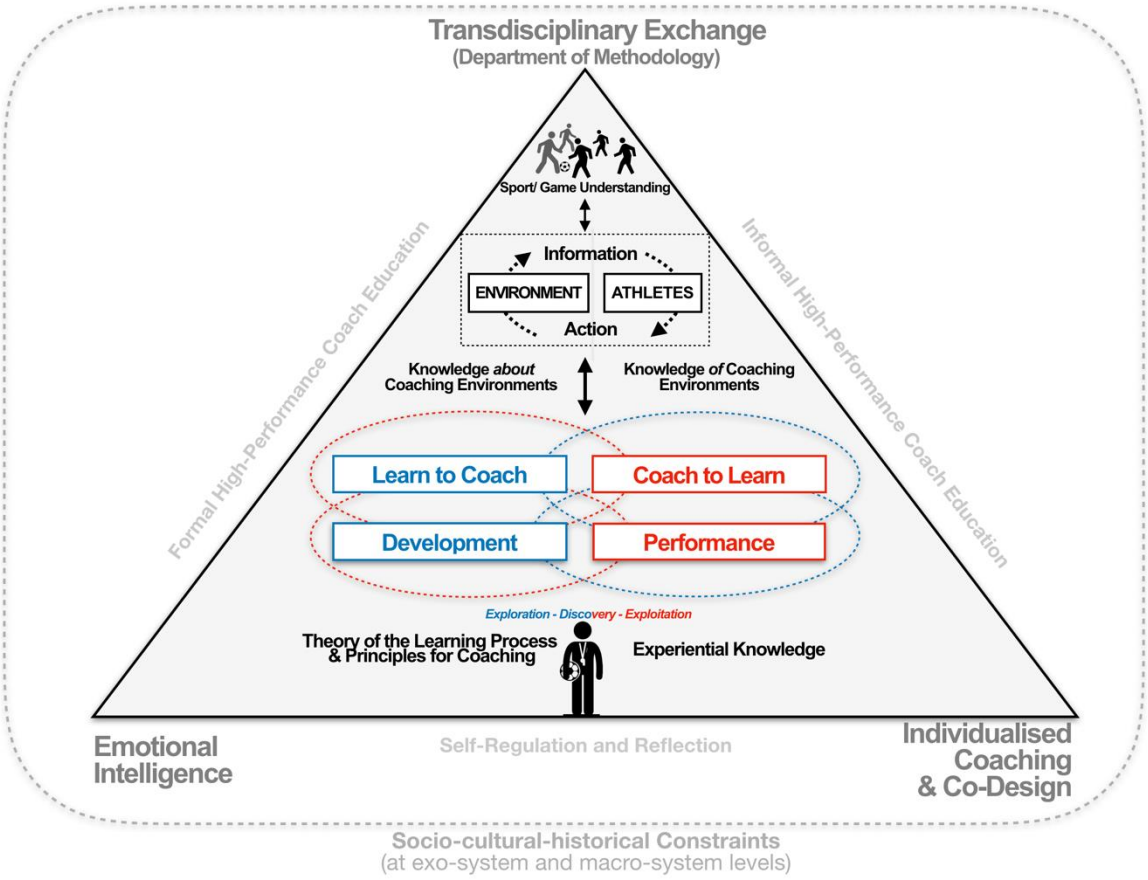


*Figure 1. Overview graphic of the multi-directional and entwined coach learning process, encompassing: (i) the mutual relationship between development AND performance, including coaches' experiential knowledge and understanding of theories of the learning process and principles for coaching; (ii) simultaneous learning processes of learning to coach and coaching to learn, including the acquisition of knowledge about and knowledge of coaching environments; (iii) an ecological and nonlinear perspective of player-environment interactions and athletes' sport-specific understanding; (iv) three critical high-performance coaching concepts of transdisciplinary exchange, emotional intelligence and individual-centred coaching and co-design of practice; and (v) the role of socio-cultural-historical constraints on exo-system and macro-system levels for coach development, including the proximity of how athletes and coaches learn, displaying a key constraint on coach learning/behaviour and shaping coaches' intentions and attention.*

*(i) How do athletes develop their skills and continue to refine their understanding of performance in their sport? A key question that all coaches need to engage with throughout their careers.*

Understanding how performance in sport can underpin development, and vice versa, appears critical for coaches when engaging with the skill learning process in sport contexts (see Otte et al., 2021, for a synthesis of theoretical ideas applied to coaching). By acknowledging the need for athletes to explore and find their own individualised ways of interacting with emerging performance contexts and sport-specific problems, the basis of skill adaptation is founded on *athlete self-regulation*, a concept that is linked to a clear principled ecological model of a nonlinear learning process (Woods et al., 2020). This principled model demands for co-creation of practice designs (replete with representative perceptual information) and enriched opportunities for athletes (and likewise coaches) to develop emotional intelligence and problem-solving abilities. These pedagogical principles allow athletes to learn to effectively negotiate changing performance environments and to gain sport-specific understanding of how different performance contexts afford and invite adaptation (see top parts inside the triangle in Figure 1; Woods et al., 2020). From a practical viewpoint, Bernstein's (1967, p.234) concept of 'repetition without repetition' in practice (i.e., repeatedly solving performance problems in a 'many times, many ways approach'; Morris et al., 2022) underlines problem-solving and decision-making activities, and learning through adaptation, which frames performance preparation in all sports. Manipulating various contextual constraints in practice (e.g., adjusting rules, targets or equipment in practice) has been advocated through the Constraints-Led Approach (CLA), a theoretical approach to skill learning that seeks to drive athletes' continuous search for, discovery and exploitation of information (see top parts inside the triangle in Figure 1 stressing information-action coupling to exploit opportunities for action and enhance sport-specific understanding; Button et al., 2020; Renshaw and Chow, 2019). Notably in skill adaptation, practice and preparation

(which emphasises intensity of performance) is important at the right time. Practice does not have to be high intensity all the time, providing space and time for athletes to develop their *knowledge of* the environment to refine functional performance solutions. The importance of 'learning to learn' through exploration and a nuanced blend of generality and specificity of practice in training regimes can support this developmental process (see Rothwell, Davids et al., 2022; and Rothwell, Rudd et al., 2022).

With a focus on performance preparation and athlete learning at the heart of coaching processes in high-performance sport, it is important to highlight the potential for an ecological approach to also support coach learning. Considering how an ecological model could afford effective interactions between coaches and their immediate contexts and environments, the concept of self-regulation through coaches learning to adapt their intentions and attention becomes invaluable. An ecological model of the learner and the learning process, seeks to pay more attention to *knowledge of* the environment (Gibson, 1979; as compared to *knowledge about* it). Here, Wood and colleagues (2023, p. 618) drew attention to this idea, highlighting that while coaches are provided with *knowledge about* the range of pedagogical strategies available for coaching an individual and team, they also need to gain *knowledge of* these processes by actively using, refining and implementing them in practice. Thus, principles outlined earlier for skill adaptation in athlete performance (see Savelsbergh et al., 2019; O'Sullivan et al., 2023) can be used to underpin learning to coach effectively. Despite there being specific principles that underlie performance in different sports, coaches may seek to learn about pedagogical methods and approaches in athlete development and preparation for performance from other coaches in different sports.

Overall, active exploration, discovery and exploitation of information by gaining knowledge of diverse coaching environments (e.g., across sexes, differing in abilities, as well as individuals and teams), appropriately blended in with knowledge about coaching

strategies, remain driving forces for coach learning as it does for athlete learning (see the interconnected oval shapes inside the triangle in Figure 1).

*(ii) An ecological dynamics rationale recognises the deeply entwined relations between athlete development and their competitive performance from their earliest experiences to their highest level of expertise.*

At first glance, coaching athletes for performance and coaching for development may be seen as two separate entities, running in parallel, with their own distinct conceptual processes and practical approaches. The main reasoning behind this suggestion is based on the psychological assumption that the timescale of performance (focusing on immediate needs and outcomes over minutes, hours and days) is different to the timescales of learning and development (needs and outcomes driving behaviours over years, months and weeks) (Thelen & Smith, 1994). Although there is overlap between these timescales and they are deeply intertwined, it is a serious misconception to consider such complex human behaviours as belonging to only one timescale of analysis. The primacy of dynamical principles in explaining *integrated* system behaviours at developmental, learning and performance scales of analysis are highlighted because "[...] such principles describe systems [...] that live in many different time scales" (Thelen & Smith, 1996, pxiii).

While it may be chronologically coherent to draw attention to different timescales for performance, learning and development, an ecological dynamics perspective recognises that human experience in performance, learning and development are all important features of skill adaptation and expertise that are deeply intertwined and inseparable (Davids, 2012). Notably, the position adopted here does not claim to narrow down coaching to merely 'two domains' (performance and development). Rather, it focuses on an ecological dynamics rationale, emanating from movement science and motor learning, for performance and development of skills and expertise, drawing parallels between performance, learning and development in athletes and in coaches.

Despite the irreducible relationship between performance and development, performance pressures imposed by the intensities of structured competition in senior professional sport may overwhelm coaches so that the traditional tendency to separate performance from development may confuse perspectives on athlete learning (e.g., encouraging coaches to over-use rather more prescriptive, direct and explicit coaching approaches (e.g., Otte et al., 2019)). A key point is that athletes have the capability to continue developing throughout their career, as do coaches. In such a competition-driven hothouse, coaches experience competing cultural and personal constraints that challenge, and possibly narrow, their own views and intentions toward their personal learning and development, ultimately influencing the need to adopt a purely performance-driven and results-oriented, immediate focus (e.g., Morris et al., 2022; O'Sullivan et al., 2023; Vaughan et al., 2022). The documented evidence shows that this professional focus limitation may downplay development needs in their work with athletes at all times, from children to elite adults. Given often severe pressures in competitive professional sport, it's possible that, like players, coaches in any context will also experience phases of needing professional reflection, re-generation, re-focus, development and adaptation, and rehabilitation of aims.

From an ecological perspective, all coaches continue to need to perform in their roles; this need, notably emerges from very early in one's career to late stages where one may have acquired a label of 'expert status'. However, at all times during their careers, coaches need to continue to develop their knowledge *about* learning and contemporise their understanding of applied sport science and pedagogy to inform their professional practice (e.g., their *knowledge of* coaching contexts) (e.g., see Savelsbergh et al., 2019; Rudd et al., 2021; Lara-Bercial et al., 2023; O'Sullivan et al., 2023). The arguments explored here can help address a clear misconception in some sport professionals who continuously locate coaching in a dualist conceptualisation of performance *versus* development. Avoiding this obvious dualism,

364 it is more valid to consider performance *AND* development as two deeply entangled
365 processes continuously influencing and shaping each other throughout the career of an athlete
366 and a coach, from beginning to end. Performance is not to be viewed as an extension of a
367 development phase, as if reaching 'elite status' signifies the end of learning and development
368 in any profession. This point was admirably demonstrated in a comparison of key differences
369 in numbers of hours spent in practice and training between UK elite (defined as medal-
370 winning competitors who attended world championships) and super-elite athletes (defined as
371 gold medal winners at world champions) (Rees et al., 2016).

372 For academics, coach developers and practitioners, it is important to view
373 performance, learning and development as being highly interlinked and equally important and
374 relevant at different timescales, a perspective that has not been highlighted rigorously enough
375 by academics in the past (for exceptions see chapters 8 and 9 in Williams, Davids &
376 Williams, 1999; Renshaw et al., 2022). An ecological rationale for performance, learning
377 and development emphasises that these concepts play a critical role in adaptive behaviours of
378 humans, considered as complex dynamical systems. One cannot perform without developing
379 and learning. One cannot develop and learn without performing throughout the whole
380 trajectory of a professional career (i.e., see oval, intertwined shapes centrally in Figure 1).

381 Although coaches are always developing, learning and performing simultaneously,
382 one may need to prioritise the relevance of each of these processes in different ways and at
383 different times. Due to newly emerging technologies, pedagogical knowledge, sport contexts
384 and scenarios, the dynamic relationship between development, learning and performance may
385 change and show a nuanced, individualised balance for different people over different
386 timescales. For example, one's focus on performance will significantly increase when
387 preparing immediately before an event or competition (e.g., a major cup final in rugby or an
388 especially challenging mountain ascent in winter); this prioritisation, compares with the

experiences of an athlete working on re-acquiring skilled perception and action integration after a serious long-term break due to injury or illness and hence, highlights a strong (re)developmental focus. The differentiation in emphasis forms the basis of individualised 'athlete-centred' coaching, for which ecological dynamics provides a clear theoretical foundation (Renshaw & Chappell, 2010; Light, 2017). Eventually, it is a challenge for the coaching staff to co-design individualised and contextualised environments that balance between training for "adaptability, functionality, and robustness of motor skills under perturbation of dynamic environments" and, at times, training with a focus on "exploiting the performance environment for maximum return or efficiency" (Otte et al., 2019, pp. 7-10). Notably, notions of athlete development, learning and performance can be viewed in immediate proximity to *coach learning*, stressing proximity as a key constraint on coach behaviour. For example, proximity to competitive performance may shape both athletes' and coaches' intentions in similar ways and hence, highlighting the *athlete-coach-environment learning system* (as displayed inside the red triangle in Figure 1)**.**

*(i) The dual coach learning pathway – how do coaches learn to coach (gaining knowledge about the environment) and coach to learn (gaining knowledge of).*

In high-performance sport, formal coach education pathways play a major role in coach development, attempting to increase coaches' understanding of athlete learning processes, aiming to enhance positive athlete development outcomes (Raya-Castellano et al., 2021). On the one hand, it appears intuitive that coaches' experiential knowledge, "based on biography, context, culture and organisation", proves to be critical (Cushion et al., 2021, p. 1). Gaining experiential *knowledge of* coaching environments over time arguably provides one invaluable pathway for coaches to develop (i.e., by coaching to learn how to adapt to the dynamic environmental and task constraints, encountering a variety of pedagogical contexts and experiences) (Wood et al., 2023). Here, it is critical for coach education to permit

coaches to "learn from 'the self and others' through discussion and reflection [… by] enabling the inclusion of reflection and discussion activities following practical activities" (Cushion et al., 2021, p. 12). From an ecological perspective, a more technical, applied scientific rationale for these anecdotal ideas, is predicated on the direct perception of affordances (opportunities for behaviours) for oneself and for others to model coaching performance (Wood et al., 2023).

On the other hand, using scientific *knowledge about* the coaching process (e.g., by learning about how to coach, using a principled ecological model to guide the learning process) displays another potentially fruitful pathway for coach development (see central parts inside the triangle in Figure 1). In relation to previous suggestions that coach education programmes may be "under-theorised" (i.e., designed without consideration of learning theory), recent anecdotal insights seemingly underline this assumption: i.e., scientific theory to support the coaching process often appears undervalued by practitioners and, in many cases, may even be viewed as unpopular for coaches within formal coach education settings. A recent empirical investigation by Cushion et al. (2021) found coaches criticising formal coaching education courses that position learning as a "linear, mechanistic and unproblematic process occurring independently of context" (p. 3). In the words of the same authors (p.11): "Coaches 'don't need theory'. In different ways, coaches and facilitators downplayed the usefulness of theory […] to sustain an agenda where 'experiential learning' was the appropriate response". This criticism of linearity of mechanistic views on coach learning in education is consistently aligned with calls for exposure to more contemporary nonlinear learning approaches (e.g., Otte et al., 2021; Chow et al., 2022; Wood et al., 2023). Such a contemporary alignment also stresses individual-centred coach learning that practically engages with the dynamic relationship that develops between coaches and their environments (Stodter & Cushion, 2017, 2019; Chow et al., 2022; Wood et al., 2023).

An ecological dynamics rationale advocates the need for a subtle blend of *knowledge about* the environment (in the form of key ecological principles which can guide coaches' search for better understanding of the learner and the learning process) and *knowledge of* the environment (coaches becoming proficient at searching for and exploiting surrounding information about relevant affordances for more effective coaching) (Wood et al., 2023). This information is important for supporting coaches' self-regulation as they intentionally navigate between 'being in the moment' and transiting across timescales of development and performance. A heavy emphasis needs to be placed on seeking and using *knowledge of* the environment so that coaches can act as 'wayfinders' on their own pathway to becoming better guides and mentors to athletes and teams (Woods et al., 2022). Here, for coaches the notions of *paying attention* to surrounding information and contextual factors in the wider environment (e.g., implications of a losing streak leading to increased media and fan pressure on players and the team) and *guiding athletes without specification* (e.g., co-designing practice tasks together with athletes and supporting their quests for problem solving; see Morris et al., 2022, for a theoretical elaboration) must be emphasised. As much as coaches aim for athletes to become adaptable problem solvers within varying, often unpredictable, sport environments, they also need to embrace the 'ethos of not knowing' by accepting the need to self-regulate and adapt behaviours within varying coaching contexts (Morris et al., 2022). To illustrate how athlete and coach development can co-exist in training environments that shift focus between performance and development, we highlight experiences of coaches in two high-performance case examples from team and individual sports.

## Case examples – High-performance coaching, coach education and athlete self-regulation

### *Case example I: High-performance coaching in preparation for the 2021 Wheelchair Rugby League World Cup.*

Here we share the third author's (MR) experiences of preparing a team to play in the 2021 Wheelchair Rugby League World Cup finals. In preparation for the World Cup cycle, a new coaching team was employed (in which the third author was an assistant coach). Following a period of observation and reflection on current team performance by the coaching team, it was clear that competitive performance was dominated by top-down influences (e.g., rigid reliance on a prescriptive game plan and dominant coach instructions and feedback). Practice under these global influences could be categorised as 'rehearsals' and 'choreography'. Under these performance conditions, on field team synergies were poor and some players felt that their performance was suppressed and inhibited by this preparation approach. While this method produced some successful results, some players reported not enjoying training or playing this way and were clearly de-motivated. From MR's perspective, these primary performance and practice experiences instigated secondary learning experiences away from the training pitch in the form of meaningful discussions with colleagues and players, reading relevant academic literature, and writing a reflective journal.

A key academic source that supported reflexive practice was Ribeiro et al.'s (2019) commentary on the role of game models and tactical principles of play to exploit top-down (e.g., game plan) and bottom-up (team synergies) influences on team self-organisation. Ribeiro et al. (2019) argued that these two distinct, co-existing influences on self-organisation tendencies can be exploited to enhance team performance. After reading and digesting this information and engaging in personal communication with the first author of the paper (João Ribeiro, University of Porto), a new performance preparation plan was developed with the players' input. Several team meetings with players led to changes being co-determined and made to the current game model. Players were challenged to identify tactical principles of play to inform game play and practice strategies. The rationale for this approach was to implement a less rigid performance model that provided players with more freedom to

492 explore and discover individualised performance solutions. More specifically, these co-
493 created flexible principles included guidance to work in pairs, explore, vary play to play
494 (early pass, change of direction, tempo), and 'stay alive' on every play. Coach observations,
495 and players' feedback of this pedagogical approach suggested that local interactions were
496 heightened due to the exploration of the principles of play according to players' unique
497 capacities and characteristics, that afforded greater player synergies. Through this process,
498 MR *coached to learn* (e.g., learning from moment to moment depending on context), through
499 primary experience and *learned to coach* (engaging with academic literature or peer
500 discussions) through engaging in more reflexive practice.
501 At this point it is important to note that MR had to display high levels of emotional
502 intelligence through the process of challenging the playing squad to think differently about
503 how the game could be played. He was cognisant of the fact that the players were being asked
504 to significantly change an approach to playing that had resulted in many previous on field
505 successes. In another example of learning to coach, BarOn's (1997; 2000) model of
506 emotional intelligence provided a point of reflection when trying to make sense of positive
507 and negative situations aligned to performance and development issues associated with
508 implementing a new game model. Although MR got frustrated by negative comments and
509 awkward conversations aimed at the new playing style, BarOn's (1997; 2000) framework
510 highlighted the value of interpersonal skills, stress management, and adaptability when
511 dealing with the players. Through the reflective process, this framework helped shape
512 intentional strategies aimed at improving interactions with the playing squad to positively
513 evolve the game model. Once a new game model had been agreed, practice moved between
514 periods of coaching for development, and training for performance. Early in the World Cup
515 cycle, coaching for development was a more prominent feature of the programme. A
516 development focus was implemented to re-engage players and to encourage more bi-

directional self-organising tendencies in team performance. Even though obvious top-down influences were removed, more subtle global tendencies in the form of the more dominant players instructing and commanding situations during practice and competition were still prominent. The challenge to the group was to ensure that these dominant global tendencies (emerging only from more experienced players) did not replace local tendencies. To facilitate more localised self-organising tendencies in the playing group, more generalised development experiences were provided that included multi-directional games where normal rugby league rules were taken away. During these games powerful global influences of senior players were negated because all individuals had to self-organise quickly to successfully compete in the multi-format games. Over time the more passive and less experienced players (under the old regime) flourished, and a new team synergy was enhanced. As the World Cup competition approached, the balance of performance and development practice experiences shifted to more of a performance-related focus (rehearsal of team strategies), while still encouraging a style of playing that favoured bottom-up influences. As this performance approach unfolded, it was clear that pre-planned methods would not have satisfied the team's development needs. Rather, performance improvements emerged from a fluid process depending on the needs of the team at specific time periods. Crucially, embracing a learning environment of this nature formed a reciprocal relationship between primary and secondary experiences, and performance or development, which enhanced the search process for functional performance solutions that continuously infused coach and athlete learning.

### *Case example II: Integrating learning theory into formal coach education in elite-level sport – supporting coaches' understanding of the relationship between performance preparation AND developmental coaching through the 'Periodisation of Skill Training' framework.*

> "By [triggering] an active and purposeful integration of coaches throughout the education process […], coach education will not be perceived as 'the authority' that solely delivers factual content on a one-way street but as the source of wisdom from which coaches can benefit throughout their career" (UEFA, 2021, p. 30)

Should (in)formal coach education engage coaches to *coach to learn* (i.e., through primary experiential knowledge) or, as much, *learn to coach* (i.e., through secondary experiences and theoretical knowledge about learning/coaching processes)? To frame a response to this question, it is advocated that both perspectives play a fundamental role in coach learning, especially when unified in coach education programs. Here, an integrated and applied approach to merging both concepts (of coaching to learn and learning to coach) in high-performance coach education will be showcased.

In responding to some coaches' doubts on use of theoretical/empirical knowledge in their education (preferencing the value placed on 'experiential knowledge'; see Cushion et al., 2021), this case example showcases current attempts of delivering high-performance coaching workshops to professional coaches in football and other Olympic sports, such as gymnastics, boxing, swimming, basketball, handball, rowing, canoeing, skiing and tennis. Three workshops took place in the UK and Germany in 2022 (virtually and in person) as part of high-performance coach developer programmes. Under the umbrella of "supporting coaches to explore key themes in performance coaching" (UK Coaching, 2023), there was an open invitation for coaches to voluntarily apply to attend a series of development workshops over the course of an entire year. The here-presented 'skill training periodisation and coach learning' workshop displayed one of several formally organised coach professional development events, with each workshop approximately lasting between 3-5 hours. Workshops were delivered by the first author of this paper (FO) and provided participating coaches with numerous opportunities to consider applications of the presented theoretical content in light of their previous coaching experiences. The delivery of these workshops aimed to educate coaches on ecological skill training theory and directly blend this knowledge about coaching contexts with coaches' experiential knowledge.

In detail, Figure 2 presents some specific workshop contents; i.e., an individualised approach towards systematic, step-by-step skill planning/periodisation and coaching by merging: A.) coaches' contextualised *experiential* knowledge of performance preparation and athlete development (e.g., experiential knowledge on training designs gained through coaching to learn); and B.) the application of the 'Periodisation of Skill Training' ('PoST') framework by Otte and colleagues (2019, 2020; i.e., underlining the notion of learning to coach by applying contemporary skill learning theory). The delivery of these workshops aimed to educate coaches on ecological skill training theory and directly blend this knowledge about coaching contexts with coaches' experiential knowledge. In order to develop individualised skill training periodisation plans, this approach was aligned with the specifics of each coach's performance context and immediate environment. Using pre-developed Microsoft Excel spread sheet templates and step-by-step planning to frame their pedagogical approach, coaches were given the chance to share and develop (through feedback and discussion) their acquired knowledge about a principled approach towards contemporary skill training.

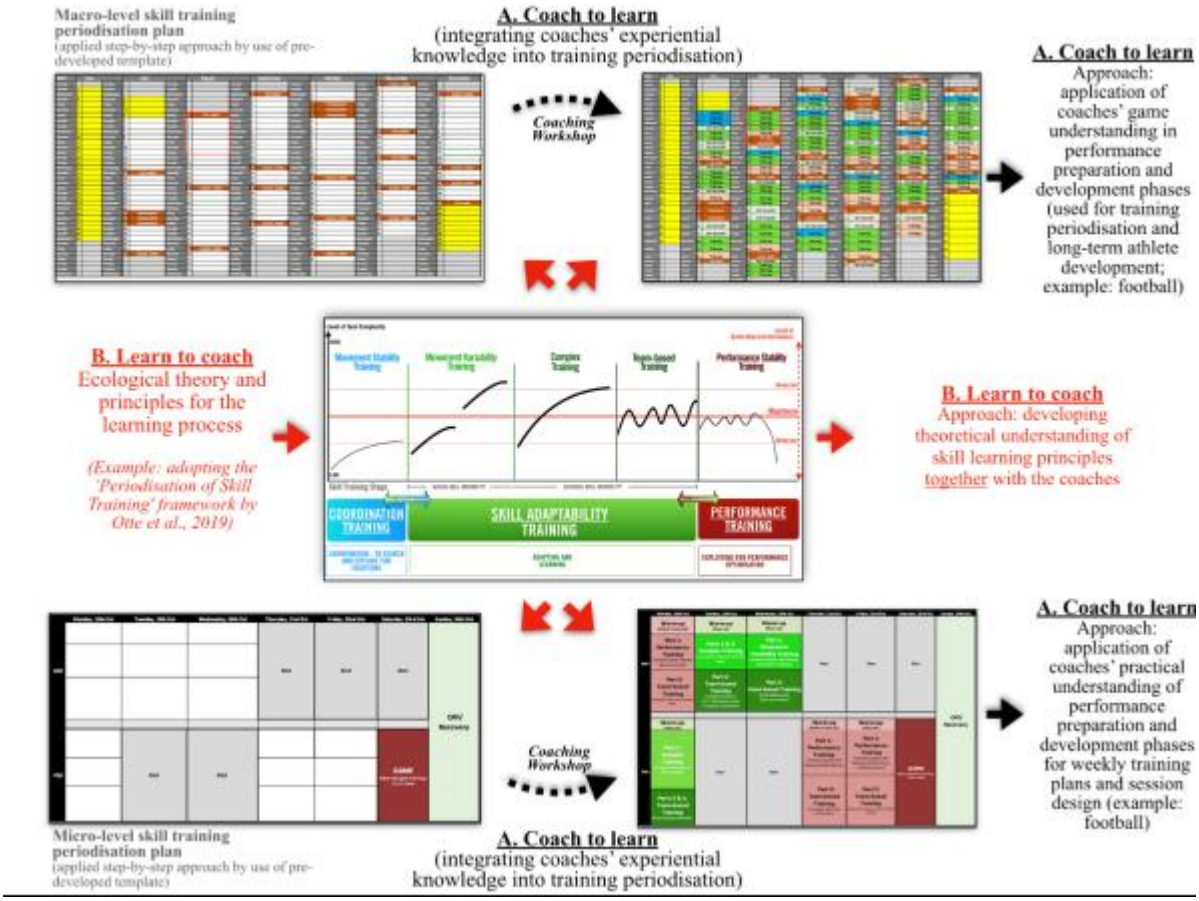


*Figure 2. Summary graphic of contents and output created in the high-performance coaching workshops, including: a macro-level training periodisation plan (top part); a micro-level periodisation plan (bottom part); the notion of 'coach to learn' by integrating coaches' primary, experiential knowledge in performance preparation and development training phases (A.); and the notion of 'learn to coach' by introducing ecological theory and skill learning principles, using the 'Periodisation of Skill Training' framework (B.; see Otte et al., 2019).*

*A.) Coaching to learn: Applied skill training periodisation by considering coaches' sport-specific understanding and experiential knowledge.*

During the coaching workshops, the workshop leader (FO) asked coaches to reflect on past experiences, their competition schedules and organisational contexts within a competition cycle (e.g., media pressure, fan interest, organisational constraints and season targets). Exploring their experiential knowledge and, in many parts, transdisciplinary understanding of their sport/game, coaches reflected on various performance preparation and development

phases throughout a season/competition cycle, with the goal of systematically pre-planning training interventions in the next step. Particularly, in high-performance sport, with practitioners being under constant pressure to achieve results, understanding and bridging the gap between performance AND development may appear a critical challenge for all coaches to grasp. Again, the deep interconnection between learning and performance appears to be vitally important for coaches to become effective *designers* of training and performance preparation environments (Chow et al., 2022). On the one hand, in professional sports like football, positive performances and results arguably display one critical perspective. Under the notion of "win trophies or be sacked" (Bentzen et al., 2020; Thomas, 2022), performance preparation aims for a maximal immediate return (i.e., physically, mentally, tactically-technically), exploiting both movement/training efficiency and team/player/coaching effectiveness (e.g., by winning a match, cup or championship title). This results-oriented perspective certainly appears to influence coaching and training approaches in ways that, for instance, may see coaches traditionally gravitate towards using more *prescriptive* coaching and limit collaboration with players and staff (see Otte et al., 2019; 2020). On the other hand, learning and development constantly remain a critical focus within any coaching context. Following the *credo* of 'context is everything', emergent athlete-environment interactions stand at the heart of ecological coaching processes and thus, should constantly drive coaches to place athletes into varied and competition-representative learning environments to search for solutions, explore and problem solve (Davids et al., 2021; Otte et al., 2019). Notably, this approach towards development should be *independent* of age group (i.e., academy or senior level), skill or performance level, predicated on key principles from a nonlinear pedagogy (see Chow, 2013). At all levels: As we perform, we learn and vice versa. Having a good understanding of this relationship can help professionals interested in sport (academics, applied scientists, practitioners) to feel comfortable with the insecurity of 'not knowing'

(Morris et al., 2022; Woods et al., 2022). The most important implication of this key idea is that individuals are empowered to self-regulate under mentorship and guidance when coaching and performing in sport. Notably, over the course of each workshop this topic of coach learning and its connection to empowerment and emotional intelligence was constantly mentioned by coaches. For example, in group discussions on how to work with, and across, a wider transdisciplinary staff, participants kept elaborating on applied examples, experiences and perceived challenges towards managing their relationships with colleagues. Hence, in future workshops, more deliberate and facilitated conversations about the importance of developing emotional intelligence may provide a fruitful opportunity. For instance, considering Goleman et al.'s (2002) dimensions of emotional intelligence, such as relationship management and social awareness, could play a fundamental role in similar workshops on coach learning.

*B.) Learning to coach: The theory behind contemporary skill training periodisation by applying the 'Periodisation of Skill Training' ('PoST') framework.*

Along with supporting coaches to continuously reflect on their experiential knowledge, introduction of contemporary skill learning theory, and its application, appeared helpful for coaches when pre-planning training for performance preparation and development phases. Hence, during the workshops, the leader (FO) aimed at helping coaches to understand theoretical principles of the framework and interactively enable coaches to apply this theoretical knowledge to their practical work. For this matter, we introduced the 'PoST' framework, originally developed for individualised coaching contexts (i.e., coaches working with individual athletes or small groups of athletes). The 'PoST' framework provides a theory-based tool towards systematic planning of skills training. Based on Newell's (1985) model of motor learning, three development stages are introduced: 'Coordination Training' (i.e., exploratory training to stabilise movement solutions and perceive relations between

perception and action), 'Skill Adaptability Training' (i.e., training environments to destabilise movement solutions, challenge problem-solving abilities and movement adaptation) and 'Performance Training' (i.e., preparation of perception, action and cognition for maximum return in competition; Otte et al., 2019). These three stages underline nonlinear athlete skill development processes, and ecological learning principles (e.g., managing the *representativeness* of learning designs, compared to competition environments, and athletes' perceived levels of task complexity during the skill adaptation process in training). Particularly, theoretical tenets of the CLA and practical implementation of (task) constraint manipulations (e.g., practice area dimensions, equipment, rules and playing surfaces) are important to consider.

*Summary: Merging experiential and theoretical/ scientific knowledge towards effective training periodisation.*

Overall, the workshops tasked coaches to (step-by-step) practically create their own monthly (macro-level) and weekly (micro-level) training periodisation plans with pre-developed spread sheet templates. Coaches were not only asked to understand key tenets of ecological training principles (derived from ecological dynamics and the 'PoST' framework), but they were also encouraged to apply these principles to their individual coaching contexts and training plans. Here, systematically switching back and forth between the three development stages (i.e., 'Coordination Training', 'Skill Adaptability Training' and 'Performance Training') challenged coaches to rethink the mutual relationship between individual athlete development and preparation for performance. The workshops simultaneously provided space for individual solutions to be shared and considered (based on each coach's localised professional context, previous experiences and background). Specifically, encouraging participants to think about avenues for transdisciplinary exchange and integration with coaches, discipline specialists and other staff members in their individual

environments formed part of the workshops. For example, one coach briefly shared experiences of how theoretical knowledge about training methodologies was previously exchanged with strength and conditioning coaches to further individualise athletes' physical development in competition-specific training sessions. Interestingly, one learning from these events for the first author (FO) is that facilitating contains the notion of even more in-depth conversations and discussions on this topic of transdisciplinary exchange in future workshops. Ideally, these workshops could invite more than one staff member (not just the lead coach in this case) to drive transdisciplinary discussions.

Finally, by offering participants various chances to implement the contemporary concepts, the coach learning programme aimed to circumvent previous criticisms of formal coach education: pursuing a 'one size fits all' agenda, constraining time parameters for learning and following too rigid, linear orders (Cushion et al., 2021; Stodter & Cushion, 2017).

**Concluding remarks and outlook to Part II**

In this article, we have re-imagined specialised skill adaption processes elite coach development in sport. We considered it as a deeply entwined relationship between the developmental process of opening up and maintaining diversity of experience, integrated with a clarity of focus on succeeding in sport competition (for detailed arguments on performance specialisation in athletes, see Richard et al., 2023). This dualist perspective, currently popularised in high-performance sport systems, eschews a compliance with reductionist tenets on separating coaching for competitive performance and development of athletes and teams.

In this insights paper, we have proposed how reductive technique acquisition can be rehabilitated through use of a more contemporary individualisation and contextualisation of sports training for athlete and coach. Development and performance preparation may be

provided in an integrated way, predicated on contemporary ecological ideas gaining more traction in high performance sports organisations (Renshaw et al., 2022). It was proposed that an emphasis on an integrated orientation towards coaching for development *and* performance may serve as a model for contemporary coach education. The experience of 'system capture' in many athlete talent development systems in high performance sports organisations can be avoided by pushing back against such restrictive tenets which advocate adherence and compliance to organisational tenets, traditionally separating development and performance coaching into separate systemic pathways (Rothwell et al., 2020). It has been argued that athlete and coach learning, are not achieved independently from one another and form part of an *athlete-coach-environment learning system*. Principles outlined for skill adaptation in athlete development can be used to underpin learning to coach effectively, particularly by highlighting an individualised *dual coach learning pathway* towards 'coaching to learn' (emphasising knowledge of the environment) and 'learning to coach' (knowledge about).

Finally, greater attention to individualised and contextualised athlete development as a form of life is provided as an opening up of opportunities for *co-designing* coach and athlete education activities, empowering individuals to self-regulate their trajectories of development, while maintaining performance effectiveness. Part II of this paper series will further explore these notions of individualised coaching, emotional intelligence, transdisciplinary exchange (between coaches within a 'Department of Methodology'; e.g., see Rothwell et al., 2020) and the role of wider socio-cultural-historic constraints on coach learning. This innovative approach, which is theoretically rationalised in ecological dynamics, holds the promise of re-defining what we might mean by 'optimality', that is the 'optimising of performance' in sport, whether coaching or performing as an athlete. Rather than optimal referring to a universal technical standard of movement, *optimising* refers to the

continuous individualisation and contextualisation of performance in coach and athlete development.

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**Figures**

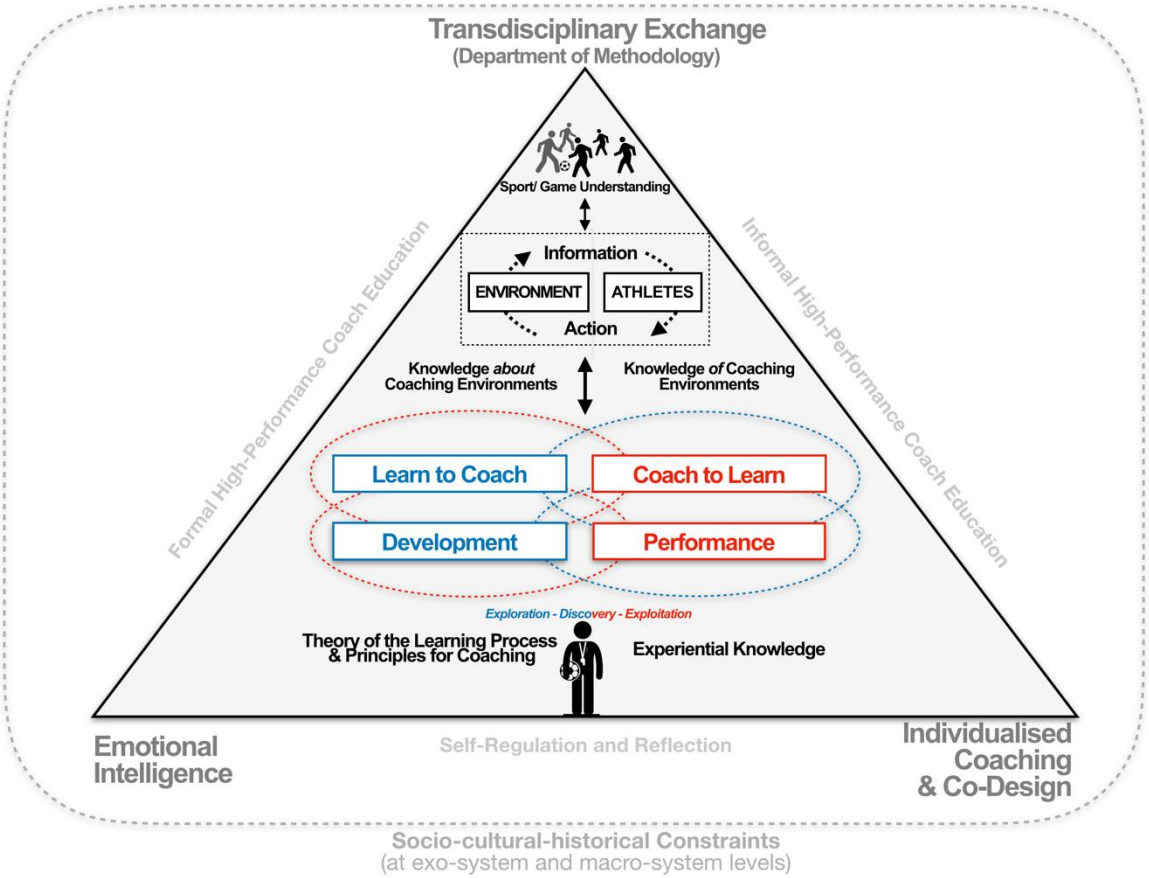


*Figure 1. Overview graphic of the multi-directional and entwined coach learning process, encompassing: (i) the mutual relationship between development AND performance, including coaches' experiential knowledge and understanding of theories of the learning process and principles for coaching; (ii) simultaneous learning processes of learning to coach and coaching to learn, including the acquisition of knowledge about and knowledge of coaching environments; (iii) an ecological and nonlinear perspective of player-environment interactions and athletes' sport-specific understanding; (iv) three critical high-performance coaching concepts of transdisciplinary exchange, emotional intelligence and individual-centred coaching and co-design of practice; and (v) the role of socio-cultural-historical constraints on exo-system and macro-system levels for coach development, including the proximity of how athletes and coaches learn, displaying a key constraint on coach learning/behaviour and shaping coaches' intentions and attention.*

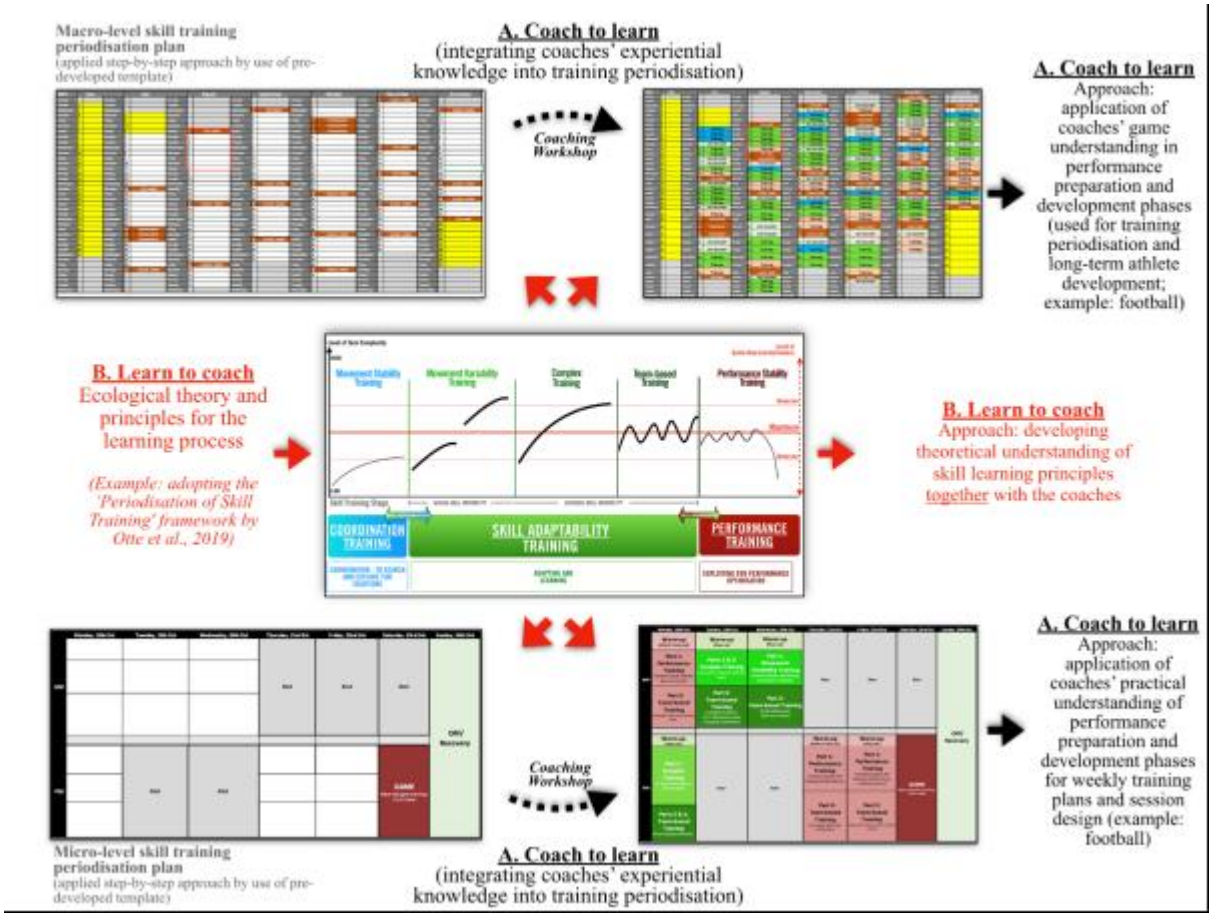


*Figure 2. Summary graphic of contents and output created in the high-performance coaching workshops, including: a macro-level training periodisation plan (top part); a micro-level periodisation plan (bottom part); the notion of 'coach to learn' by integrating coaches' primary, experiential knowledge in performance preparation and development training phases (A.); and the notion of 'learn to coach' by introducing ecological theory and skill learning principles, using the 'Periodisation of Skill Training' framework (B.; see Otte et al., 2019).*